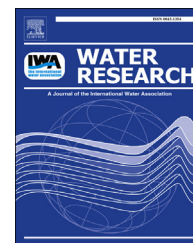




ELSEVIER

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

ScienceDirect

journal homepage: [www.elsevier.com/locate/watres](http://www.elsevier.com/locate/watres)

# Life cycle assessment of urban wastewater systems: Quantifying the relative contribution of sewer systems

Eva Risch <sup>a,\*</sup>, Oriol Gutierrez <sup>b</sup>, Philippe Roux <sup>a</sup>, Catherine Boutin <sup>c</sup>,  
Lluís Corominas <sup>b</sup>

<sup>a</sup> Irstea, Research Unit: Information & Technologies for Agro-processes, UMR ITAP Montpellier, France

<sup>b</sup> Catalan Institute for Water Research, ICRA, Scientific and Technological Park of the UdG, Girona, Spain

<sup>c</sup> Irstea, Research Unit: Freshwater Systems, Ecology and Pollution, UR MALY Lyon, France

## ARTICLE INFO

### Article history:

Received 13 August 2014

Received in revised form

7 November 2014

Accepted 10 March 2015

Available online 19 March 2015

### Keywords:

Construction

Inventory

LCA

Methane

Sulphide

Wastewater treatment

## ABSTRACT

This study aims to propose a holistic, life cycle assessment (LCA) of urban wastewater systems (UWS) based on a comprehensive inventory including detailed construction and operation of sewer systems and wastewater treatment plants (WWTPs). For the first time, the inventory of sewers infrastructure construction includes piping materials and aggregates, manholes, connections, civil works and road rehabilitation. The operation stage comprises energy consumption in pumping stations together with air emissions of methane and hydrogen sulphide, and water emissions from sewer leaks. Using a real case study, this LCA aims to quantify the contributions of sewer systems to the total environmental impacts of the UWS. The results show that the construction of sewer infrastructures has an environmental impact (on half of the 18 studied impact categories) larger than both the construction and operation of the WWTP. This study highlights the importance of including the construction and operation of sewer systems in the environmental assessment of centralised versus decentralised options for UWS.

© 2015 Elsevier Ltd. All rights reserved.

## 1. Introduction

Life cycle assessment (LCA, standardised ISO-14044) has become one of the reference methods used to assess the environmental performance of processes over their complete

life cycle from raw material extraction, infrastructure construction and operation to final dismantling. Several LCA studies have been conducted since the 1990s to assess the environmental impacts caused by wastewater treatment systems as reviewed in [Corominas et al. \(2013\)](#). [Table 1](#) complements the review of [Corominas et al. \(2013\)](#) and lists the

*Abbreviations:* BOD<sub>5</sub>, 5-day biochemical oxygen demand; CH<sub>4</sub>, methane; COD, chemical oxygen demand; CP, basic components; DIN, dissolved inorganic nitrogen; FU, functional unit; GHG, greenhouse gas emission; H<sub>2</sub>S, hydrogen sulphide; H<sub>2</sub>SO<sub>4</sub>, sulphuric acid; HRT, hydraulic retention time; LCA, life cycle assessment; LCI, life cycle inventory; LCIA, life-cycle impact assessment; N, Nitrogen; N<sub>2</sub>O, nitrous oxide; PE, population-equivalent; SE, sub-assemblies; SR, sewer subsets; UWS, urban wastewater system; WWTP, wastewater treatment plants.

\* Corresponding author.

E-mail addresses: [eva.risch@irstea.fr](mailto:eva.risch@irstea.fr) (E. Risch), [ogutierrez@icra.cat](mailto:ogutierrez@icra.cat) (O. Gutierrez), [philippe.roux@irstea.fr](mailto:philippe.roux@irstea.fr) (P. Roux), [catherine.boutin@irstea.fr](mailto:catherine.boutin@irstea.fr) (C. Boutin), [lcorominas@icra.cat](mailto:lcorominas@icra.cat) (L. Corominas).

<http://dx.doi.org/10.1016/j.watres.2015.03.006>

0043-1354/© 2015 Elsevier Ltd. All rights reserved.



Download English Version:

<https://daneshyari.com/en/article/4481129>

Download Persian Version:

<https://daneshyari.com/article/4481129>

[Daneshyari.com](https://daneshyari.com)